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ABSTRACT

The educational literature provides extensive evidence of concern with the issue of an integration of humanities and social sciences within higher education to meet the requirements of modern technology and society. This concern is also reflected in the numerous structural and functional changes in higher education, particularly in technical professional schools, that have attempted to integrate knowledge into a new paradigm. A study was conducted at the Rochester Institute of Technology (RIT) to survey student knowledge of liberal arts subjects prior to the introduction of a structured required humanities and social sciences program. The scores achieved by the random sample of 259 students ranged from a low of 0.50 to a high of 9.67 (out of a possible perfect score of 10), with the median being 5.00 and the mean being 5.28. The mean and median scores of upper classmen, lower classmen, and transfer students closely coincided, and all standard deviations were invariably high. Student background, academic major, and timing of exposure to course material in humanities and social sciences were found to be intervening variables of significant salience. Study findings lead to suggestions for the restructuring of curricula and the rearrangement of instructional materials traditionally allocated to differing levels of the educational system. Three versions of the liberal arts test are included, along with data from the study. (EJV)

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A Dual or Segmented Curriculum for Higher Technical and Professional Education

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Abstract

In literature, there is extensive evidence of concern about the integration of humanities and social sciences into higher education in a manner that would meet the requirements of modern technology and contemporary society. In addition, a long record of efforts by individual schools and professional associations tesitifies to the urgency of the issue.

Empirically testing the effectiveness of one approach to combine career training and liberal education, a sample survey of student achievement produced data which can be used for purposes of comparison with data resulting from the application of alternative models.

It is being suggested that restructuring of curricula and instructional levels at which various subjects are taught may be a workable solution to the problem at hand.

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A quarter of a century has now passed since Baron Snow delivered his Cambridge Rede lecture and published the Two Cultures,[1] pointing to the cleavage he perceived as existing between the artes, especially the artes liberales now in the form of humanities, and the techne in the vestments of modern science and technology. The practitioners -- and teachers -- of either, he said, knew little, if anything, about each other. The communication between them was difficult, indeed impossible, an intolerable condition, he thought, in view of the fact that the tools and the stock in trade of neither are capable, on their own, to provide for human needs.

Since that time there appeared at least half a dozen works on higher education,[2] each of which, in its own way, proposing curricula that would guarantee that future professionals would be adequately prepared for their subject-related task as well as for participation -- indeed leadership -- in, cultural and social affairs and decision making. Additionally, there were numerous statements by leading educational foundations and associations,[3] as well as major proclamations by governmental agencies.[4]

More directly related to higher technical education, a continuous stream of related works actually predates Snow, although the bulk seems to coincide with the time of hightened sense of urgency. Thus, under the auspices of the United Nations Educational, Scientific and Cultural Organization (UNESCO), Professor Julius Gould of the University of Nottingham in England analyzed patterns of curricular inclusion of social sciences at technical colleges and universities in a number of countries (Czechoslovakia, France, West Germany, India, Japan, Sweden, the Soviet Union, United Kingdon, and the United States).[5]

In the United States, American Society for Engineering Education (ASEE)

commissioned Professor Sterling P. Olmsted, then of Rensselaer Polytechnic, to prepare a model for utilization of humanities and social sciences by American institutes of technology (e.g., Cal Tech, MIT, RIT, VPI) that were originally developed after the French ecoles polytechniques.[6]

Similarly, though involving a larger array of instructional subjects, in Germany, this time sponsored by the Association of German Engineers (VDI), Professor Martin Polke of the Leverkusen Institute and his colleagues investigated through an extensive survey the curricular conditions "as they are" and "as they ought to be" in that country, but also reflecting pretty well the situation in areas of German cultural influence.[7]

A number of symposia and comparable academic proceedings also devoted their programs, either wholly or in part, to the same question (Bielefeld University Colloquia on Professions and Education in 1973 and 1974; New York Sociological Association in 1977; International Congress for Engineering Education, Darmstadt, 1978; Symposium on Post-Industrial Culture, Technology, and Public Sphere at the University of Wisconsin, 1979; Miami University National Conference on Interdisciplinary Studies, 1979; Symposium on Engineering Education, Ulm, 1982; American Society for Engineering Education, 1983; and International Society for Engineering Education, Budapest, 1985), to some of which the presenters of this paper have previously contributed.[8]

Additional references could be listed in large quantities, all having significant, direct or potential, implications for curricular structuring in higher education -- for instance, a growing literature, albeit of varying significance and widely divergent philosophical orientations, on the interfacing of science, qua science or qua practice, and humanities, respectively humanities-based policies and practices[9]; the surge of STS (Science, Technology, and Society) type of college and university courses, programs, and departments[10]; the extensive work by the Tavistock group on socio-technical

systems[11]; the appearance of major periodicals dedicated entirely to the issue[12]; even the publication in Moscow of the collectively authored anthology Man, Science, Technology.[13]

All this gives the impression that we may well be caught up in one of those times in history when ideas about the kind of knowledge man should seek come into conflict. Such were the clashes between philosophy and poetry or rhetoric in the Antiquity, between pagan and orthodox learning in early Christianity, theology and liberal arts in the Middle Ages, between the scholastics and the humanists during Renaissance, the traditionists and the modernists during the 1600's and 1700's, and the scientists and the religionists in the 1800's. Humanities, in one guise or another, it would appear, have always been in the contest. Presently, in their high form, they are confronting science and technology, in their high form, in search of a new balance, or, at least, that would be the contention of the "two cultures" argument.

But that is not the subject of this paper, although we are forced to agree that, whether sparked by intellectuals like C.P. Snow or propelled by internal dynamics of development within respective disciplines (or discipline groups) themselves, efforts at integration of knowledge into a new paradigm are a reality. In institutions of higher learning, particularly in technical professional schools, that is reflected unmistakably in numerous structural and functional changes.

Looking, however, at all these endeavers, as well as existing and proposed educational programs, we are equally forced to agree that we are far from being through with the conflict. And that results in the additional burden for the educators: trying not to take sides, they must carry both loads, the artes and the techne, while aiming at instructional efficiencies within the time framework culturally allocated as proper and cost factors that are economically realistic.

What emerges is an enormous diversity,[14] but also an indication of a

continuing, almost frantic pursuit of a uniform formula, the "best," universally acceptable, almost utopian model amidst reports of widespread dissatisfaction and ineffectiveness. What is more, there also emerges a recurrent conceptual split between models of "instrumental" integration of curricular subjects from humanities and social sciences with subjects from natural sciences and technology, and models viewing the former (loosely termed the "liberal arts") as matters of personal enrichment and means of ethical formation for the students (and ultimately practitioners) of the latter and, therefore, requiring a "pluralistic" curriculum.

The commitment to the one or to the other of these conceptual approaches entails widely divergent, though predictable -- thus plannable and presumably controllable -- consequences. Unfortunately, few existing programs have been created or are being operated on the basis of paradigmic niceties even of such simple nature, and the jump between intentions, assuming they were reached along the lines of one of these models, and practical realities introduces a host of intervening variables or "filters" which tend to acquire causative significance of their own. Thus, scheduling time, the curricular "carrying capacity," standards of occupational conventions, financial priorities, personnel and vested interests, tradition, and bureaucratic inertia, all enter into the picture, resulting in a hybrid conceptual model of forced (existentialist?) eclecticism, virtually guaranteeing results not in line with stated or implied intentions.

To verify that thesis, we surveryed student substantive knowledge (not their attitudinal stance) in subjects conventionally associated with liberal arts at our own institution, a middle-sized, private school of higher technical education of recognized national standing located in the Northeastern section of the United States. The survey took place prior to the introduction of a "structured" program obligatory to students irrespective of their majors,

designed to move humanities and social sciences from a marginal position to that of a major and equally emphasized status. For purposes of comparison, we intend to repeat the survey after a reasonable period of transition and measure the effectiveness of introduced changes. Thus, the undertaking should be seen in terms of a typical before-and-after research strategy.

We administered a simulated test such that high passing scores would be indicative of greater, and lower scores would be indicative of lesser command of subjects in question. Since student exposure to subjects in question ranged from no courses ever taken to seven or more, the expectation was that students with more exposure, as an aggregate, would perform better than those with less exposure, assuming, that is, that there is a cause-and-effect relationship between teaching and learning in a formal, purpose-justified setting.

A random, though internally stratified, sample of 259 students involved lower classmen (91), upper classmen (94), and, in order to control for the possibility of uniqueness of the "indigenous" population, transfer students who matriculated as upper classmen on the basis of under-classmen work elsewhere (74).

The scores achieved by the students in the sample ranged from a low of 0.50 to a high of 9.67 (out of a possible perfect score of 10) in a distribution approximating the bell-shaped curve one would normally expect for values achieved when applying a valid instrument to a population known to differ randomly on characteristics being measured. The median (5.00) and the mean (5.28) practically coincide, and the standard deviation (1.78) confirmed the expected distribution within reason.

But, even though the impressionistic and anecdotal type of information available before the survey led us to expect low levels of correlation between hypothesized variables -- for, after all, that was the reason for introducing the curricular reform in the first place -- the data obtained indicated almost

identical platykurtic unskewed bell distributions of achieved scores also for lower classmen, upper classmen, and transfer students, for students who had varying levels of exposure to courses in purview, and, finally, when controlling for both.

In each case, the scores had a wide range, practically always including the highest or near highest value, as well as very low, if not the lowest, values. Means and medians again closely coincided, and all standard deviations were invariably high.[15] The originally intended use of conventional tests of significance, the chi-square routine and the difference-of-means test, was superfluous. These findings well support our thesis, and we are convinced that it is generalizable.

There were indications of some exceptions, however, that resulted from attempts to carry the multivariate analysis beyond the point conventionally justified by the number of cases available. They point to student background, the major, and the timing of exposure to course material in humanities and social sciences as intervening variables of significant salience. The first of these has been well known in literature for more than a generation,[16] and it deals with social and economic conditions beyond the influence of instructional policies of individual institutions, possibly also beyond manipulability in contemporary social systems, and thus, simply, a given.

The second, very plausibly, pertains to actual and perceived compatibility (relevance, needs) between the disciplines, the latter of which -- the attitudinal atmosphere -- was investigated by Dean Emeritus VanderMeer of Pennsylvania State on the basis of national and localized sample surveys replicated over a time interval of about twenty years. In these efforts, the use of the semantic-differential technique indicated that, in spite of a decline in regard for liberal arts per se, in this instance by engineering faculties, the "favorability index" and obtained statements about curricular requirements perceived as important by the repondents strongly suggest, contrary to popular

beliefs, "considerable enthusiasm" for specific courses in humanities and social sciences.[17]

But the last suspected intervening variable, the timing of student exposure, could very possibly be the key to the enigma addressed in this paper, and it appears to tie in quite well with the readiness stage, learning curve, and over-saturation aspects of the learning theory. It seems also to have been the thought behind innovative post-secondary institutions, based on a rearrangement of instructional materials traditionally allocated to differing levels of the educational system.[18]

That thought, we would argue, holds the promise for at least one half of an integration model of prime utility for programs of higher education in the fields of science and technology. A tech prep, if not a totally comprehensive preparatory in-between stage, combining upper grades of secondary and much of the lower division post-secondary curricula (communications, math, science, art, social sciences), must be viewed as a welcome alternative to the present two-track system separating the academically and the vocationally destined, in itself an irony in societies in which equalitarianism is the byword.

But even ideological considerations aside, neither of these two tracks is adequately functional. In practice, the vocational tracks in many schools develop abilities well below those required in the contemporary world of work while, at the same time, effectively precluding transfers into "academic" programs. The academic tracks, in turn, carrying a heavy legacy of "classical" tradition, are often no guarantee either for adequate preparation for higher education in modern professions, although they effectively preclude direct entrance into meaningful employment.

Tech prep should permit both alternatives. This is all the more important since surveys show no abrupt dichotomies in professional qualification requirements for scientific and technical personnel.[19] Instead, a graduated,

staged, talent-and-opportunity based occupational structure is seen as intertwined with continuous, often simultaneous and intermittent, education. Formal programs in institutions of higher learning, therefore, must adapt to that reality by allowing for more versatility than the conventional curricular structure foresees.

Tech prep should also pick up the formative, "enrichment" aspects which the liberal arts (the "pluralistic" according to one conceptual model) are intended to serve in post-secondary institutions. That is what we meant by one half of the integration. The other half, consisting of the "instrumental" aspects of humanities and social sciences, should, then, pose no problem for a fully functional integration within curricular models for education of professionals, making the rhetoric of "two cultures" on the campus obsolete.

However, for that to take place, it will be necessary for educational polemic to expand and include the content matter -- in this case scientific and technological knowledge -- in addition to, and some would say prior to, concerns with the cognitive processes, "self-actualization," social goals and issues, academic rationalism, and so on. In addition, systems of student guidance will have to undergo a serious reorientation away from their present "social sorting" function. And, finally, a close cooperation with industry will have to assure a continuous flow of feedback information so vital to the cybernetics of educational institutions.

[1] C.P. Snow, The Two Cultures and the Scientific Revolution, Cambridge 1959. Also The Two Cultures: A Second Look, Cambridge 1964.

[2] E.g., L. Davis, Liberal Studies and Higher Technology, Wales, 1965, D. Bell, Reforming of General Education, Columbia 1973; E. Huning et al., Ingenieur-Ausbildung und Soziale Verantwortung, VDI 1975; D. Riesman, On Higher Education, Jossey-Bass 1981; Z.F. Gamson et al., Liberating Education, Jossey-Bass 1984.

[3] E.g., C. Pace, Demise of Diversity: Eight Types of Institutions, Carnegie 1974; Carnegie Foundation, Missions of the College Curriculum, 1977; C.H. Schulman, Rewamping Core Curricula, AAHE 1979; J.G. Gaff et al., General Education, AAC 1980; E.L. Boyer and A. Levine, A Quest for Common Learning, Carnegie 1981; ACE, General Education Requirements in the Humanities, 1985.

[4] E.g., U. S. Commission on Humanities, Humanities in American Life, California 1980; W.J. Bennett, "To Reclaim A Legacy," Chronicle of Higher Education, November 28, 1984; C.M. Boyer, Five Reports: Summaries of Recent Commission Reports on Improving Undergraduate Education, Denver 1985.

[5] J. Gould and D.H. Smith, Teaching of Social Sciences in Higher Technical Education, UNESCO 1968.

[6] Liberal Learning for the Engineer, ASEE 1968.

[7] H. Hillmer, W. Peters, and M. Polke, Studium, Beruf und Qualifikation der Ingenieure, VDI 1979.

[8] E.g., B.H. Mikolji, "Functioning of Humanities and Social Sciences in Higher Technical Education," National Conference on Interdisciplinary Studies, Miami University, April 1979; T.R. Plough, "Liberal Learning as Career Preparation," International Conference on Improving University Teaching, Berlin, Summer 1982; B.H. Mikolji, "Social Sciences in Technical Studies," Symposium on Engineering Education, Ulm, October 1982 (also in A. Melezinek, ed., Internationale Ingenieur-Ausbildung, Bohmann 1982); T.R. Plough and B.H. Mikolji, "Theory of Socio-Technical Systems and its Implications for Engineering Education," International Society for Engineering Education, Budapest, August 1985 (also in R. Szucs et al., eds., Ingenieurpadagogik: Losungsansatze im Internationalen Vergleich, Leuchtturm 1985).

[9] E.g., J. Ellul, La Technique, Colin 1954; J. Bronowski, Science and Human Values, Messner 1956; T. Kuhn, Structure of Scientific Revolutions, Chicago 1962; H. Marcuse, One-Dimensional Man, Beacon 1964; J. Habermas, Technik und Wissenschaft als Ideologien, Suhrkamp, 1968; R.A. Bauer, Second Order Consequences, MIT 1969; W. Carlton, Technology and Humanism, Vanderbilt, 1970; G. Ropohl, Eine Systemstheorie der Technik, Hanser 1979; M.A. Borough, Technology Assessment, North Holland, 1980; J. Weinstein, Sociology/Technology, Transactions, 1982.

[10] The most recent EVIST Resource Directory (American Association for the Advancement of Science) lists about 120 programs and 900 continuously offered courses in the United States alone.

[11] Tavistock Institute of Human Relations, London.

[12] E.g., Technology and Culture; Science, Technology, and Human Values; Technology and Society; Impact of Science on Society.

[13] Chelovek-Nauka-Technika, Akademia Prague, 1973.

[14] For a presentation of "congealing" patterns coinciding, respectively, with forms of technological development, socially institutionalized "division of labor," the type of economy (market vs. planned), etc., see Mikolji, "Social Science. . . " in Melezinek, op. cit.

[15] Test scores achieved by student standing and number of courses taken:

		1-3	4-6	7+	?	ALL
LOWER CLASSMEN	N	35	47	6	3	91
	R	1.33-8.50	1.67-8.33	1.67-9.00	1.17-5.33	1.17-9.00
	M	5.00	5.33	6.17	5.17	5.17
	X	4.98	5.27	5.89	3.89	5.21
	SD	1.92	1.74	2.42	1.92	1.74
UPPER CLASSMEN	N	7	12	67	8	94
	R	2.33-8.33	1.33-7.33	2.33-9.67	3.00-8.00	1.33-9.67
	M	4.83	4.50	5.33	6.00	5.04
	X	4.68	4.42	5.57	5.67	5.38
	SD	1.79	1.74	1.68	1.53	1.74
TRANSFER STUDENTS	N	23	26	17	8	74
	R	0.67-6.84	1.33-9.33	0.50-9.00	2.33-7.83	0.50-9.33
	M	4.33	5.00	4.17	5.17	4.67
	X	4.33	4.76	3.85	5.38	4.67
	SD	1.81	1.76	2.05	1.73	1.38
ALL STUDENTS	N	65	85	90	19	259
	R	0.67-8.50	1.33-9.33	0.50-9.67	1.17-8.00	0.50-9.67
	M	4.67	5.17	4.25	5.33	5.00
	X	4.72	4.99	5.17	5.27	5.08
	SD	1.89	1.79	2.06	1.78	1.78

[16] E.g., R. T. Potter, "Portrait of a Workingman's College," Dissent, 11/4; H.A. Katchadourian and J. Boli, Careerism and Intellectualism Among College Students, Jossey-Bass 1985.

[17] A.W. VanderMeer, "Issues of the Design and Implications of the Humanities and Social Science Component of Engineering Curriculums," in C.P. Grayson and J.M. Biedenbach, Images for the Future. ASEE 1983; M.D. Lyons, Liberal Arts as Viewed by Faculty Members in Nine Professional Schools and Three Types of Universities, Alabama 1978; A.W. VanderMeer and M.D. Lyons, "What Engineering Faculty Believe About the Liberal Arts," Engineering Education, 11/2.

[18] E.g., Ricci College Seattle Preparatory, Washington, and Simons Rock College, Massachusetts. Note also the Gesamtschule movement in Germany, the Scuola Unificata movement in Italy, as well as, in some aspects, the community college movement in the United States. See also Idea Book for Colleges and Universities, AED, 1979; C. Adelman, "Teamwork for Secondary and Post-secondary Education," AAHE Bulletin, December 1983; G.I. Maeroff, School and College Partnership in Education: Carnegie 1983; Forum for Liberal Education, 5/5 (9, 10); Nation's School Report, 5/2, (4-6): Chronicle of Higher Education, May 29, 1979 (12) and March 14, 1984 (1); and D. Parnell, Neglected Minority, Community College Press 1985.

[19] Twenty of the fastest growing occupations from 1982 to 1985 called for advanced but not necessarily highest education (Parnell, op. cit.), and establishments in "high tech" or on the frontiers of science frequently depend on top talent development through extra-institutional channels.

EXHIBIT 1: WORKING HYPOTHESES

H_1: U > L

H_2: Div 1_L = Div 2_L = . . . = Div 7_L

H_3: Div 1_U = Div 2_U = . . . = Div 7_U

H_4: Div 1_U > Div 1_L

H_5: Div 2_U > Div 2_L

H_6: Div 3_U > Div 3_L

H_7: Div 4_U > Div 4_L

H_8: Div 5_U > Div 5_L

H_9: Div 6_U > Div 6_L

H_{10}: Div 7_U > Div 7_L

H_{11}: (7+) > (4-6) > (1-3)

H_{12}: Div $1_{(7+)}$ > Div $1_{(4-6)}$ > Div $1_{(1-3)}$

H_{13}: Div $2_{(7+)}$ > Div $2_{(4-6)}$ > Div $2_{(1-3)}$

H_{14}: Div $3_{(7+)}$ > Div $3_{(4-6)}$ > Div $3_{(1-3)}$

H_{15}: Div $4_{(7+)}$ > Div $4_{(4-6)}$ > Div $4_{(1-3)}$

H_{16}: Div $5_{(7+)}$ > Div $5_{(4-6)}$ > Div $5_{(1-3)}$

H_{17}: Div $6_{(7+)}$ > Div $6_{(4-6)}$ > Div $6_{(1-3)}$

H_{18}: Div $7_{(7+)}$ > Div $7_{(4-6)}$ > Div $7_{(1-3)}$

H_{19}: U = T

H_{20}: Div 1_T = Div 2_T = . . . = Div 7_T

H_{21}: Div 1_U = Div 1_T

H_{22}: Div 2_U = Div 2_T

H_{23}: Div 3_U = Div 3_T

H_{24}: Div 4_U = Div 4_T

H_{25}: Div 5_U = Div 5_T

EXHIBIT 1 (continued)

H_{26}: Div 6_U = Div 6_T

H_{27}: Div 7_U = Div 7_T

H_{28}: $U_{(1-3)} = T_{(1-3)}$

H_{29}: $U_{(4-6)} = T_{(4-6)}$

H_{30}: $U_{(7+)} = T_{(7+)}$

EXHIBIT 2a: QUESTIONNAIRE ADMINISTERED TO SAMPLE SEGMENT A (N=83)

Major

Year

Years at this school

Number of liberal arts courses

In brief, give the content of the First Amendment to the Constitution of the United States of America.

Estimate the present size of the population of the United States.

State the theorem of Pythagoras.

Name three from among the ten longest rivers in the world.

Who was Robert Frost?

Name two U.S. Presidents whose office terms were held between the presidency of George Washington and that of Abraham Lincoln.

Give three examples of words called adjectives.

Name three contemporary American artists and their respective fields.

Syllabify (hyphenate) the word "customarily."

Estimate the approximate distance between New York and Los Angeles (in miles).

EXHIBIT 2b: QUESTIONNAIRE ADMINISTERED TO SAMPLE SEGMENT B (N=91)

Major

Year

Years at this school

Number of liberal arts courses

In brief, give the contents of the Second Amendment to the Constitution of the United States of America.

Name three from among the ten highest mountain peaks in the world.

Give the formula for the circumference of a circle.

Name two U.S. Presidents whose office terms were held between that of Abraham Lincoln and that of Herbert Hoover.

Name three countries in Central America.

In brief, state the function of federal courts in the United States.

Who was Walt Whitman?

Syllabify (hyphenate) the word "reciprocate."

Give three examples of words called prepositions.

Name three native America Indian tribes.

EXHIBIT 2c: QUESTIONNAIRE ADMINISTERED TO SAMPLE SEGMENT C (N=85)

Major

Year

Years at this school

Number of liberal arts courses

Name the personal (nominative) pronoun for the first person singular in any of its forms.

In brief, give the contents of any three amendments to the Constitution of the United States of America.

Give three commonly used words and their antonyms.

What is a "meridian"?

List three largest (in terms of land size) states in the U.S.

In which century was the American Revolution fought and the Constitution of the United States written?

Write "one billion" in its numerical form.

Name two contemporary American literary authors and cite one work written by each of them.

Name three countries in the Far East.

Give the formula used to figure the volume of a cube.

EXHIBIT 3: SAMPLE AND SEGMENT SIZE AND DERIVATION

	1982/83					1983/84			
	INSTR. A		INSTR. B			INSTR. A	INSTR. B		TOTALS
SEGMENT A	8	10	12	11	15	5	12	10	83
SEGMENT B	9	8	13	13	12	4	16	16	91
SEGMENT C	7	8	3	12	14	4	14	13	85
TOTALS	24	26	38	36	41	13	42	39	259

EXHIBIT 4: SAMPLE AND SEGMENT CHARACTERISTICS: BY DIVISON AND NUMBERS OF COURSES

		Segment A (N=82)				Segment B (N=91)				Segment C (N=86)			
		1-3	4-6	7+	?	1-3	4-6	7+	?	1-3	4-6	7+	?
DIV 1	L	4	1			5	4	2		3	2		1
	U	1	1	6			1	5	2				
	?												
	T		1	1		2	3			2	1	2	1
DIV 2	L	3	4	3			4		1	2	6	1	
	U	1	1	3	1		1	4		1	1	5	1
	?												
	T	1	2		1	6	6		2	4	3	2	
DIV 3	L	2	4			2	1			1	2		
	U			2				4			3		
	?												
	T	1				2	1	2			3	1	1
DIV 4	L	1	1								2		
	U		1	3				2				6	1
	?												
	T		1	1		1	1	2					
DIV 5	L	1	4			5	6			1	4	1	1
	U		1	12		1		7		3	2	3	
	?												
	T		1	1	1			1	1	1	2	1	
DIV 6	L		1	1			1						
	U			1									
	?												
	T		1		1	1		1				2	
DIV 7	L	1								3	1		
	U			1	1			1				1	
	?												
	T	1											
?	L												
	U											1	1
	?												
	T												
TOTALS		17	25	35	5	25	29	31	6	21	32	26	7

EXHIBIT 5: STUDENT SCORES BY CLASSMANSHIP AND EXPOSURE

		1-3	4-6	7+	?	ALL
LOWER CLASSMEN	N	35	47	6	3	91
	R	1.33-8.50	1.67-8.33	1.67-9.00	1.17-5.33	1.17-9.00
	M	5.00	5.33	6.17	5.17	5.17
	X	4.98	5.27	5.89	3.89	5.21
	SD	1.92	1.74	2.42	1.92	1.74
UPPER CLASSMEN	N	7	12	67	8	94
	R	2.33-8.33	1.33-7.33	2.33-9.67	3.00-8.00	1.33-9.67
	M	4.83	4.50	5.33	6.00	5.04
	X	4.68	4.42	5.57	5.67	5.38
	SD	1.79	1.74	1.68	1.53	1.74
TRANSFER STUDENTS	N	23	26	17	8	74
	R	0.67-6.84	1.33-9.33	0.50-9.00	2.33-7.83	0.50-9.33
	M	4.33	5.00	4.17	5.17	4.67
	X	4.33	4.76	3.85	5.38	4.67
	SD	1.61	1.76	2.05	1.73	1.38
ALL STUDENTS	N	65	85	90	19	259
	R	0.67-8.50	1.33-9.33	0.50-9.67	1.17-8.00	0.50-9.67
	M	4.67	5.17	4.25	5.33	5.00
	X	4.72	4.99	5.17	5.27	5.08
	SD	1.89	1.79	2.06	1.78	1.78

EXHIBIT 6a: DISTRIBUTION OF STUDENT SCORES BY PERCENTAGES: ALL STUDENTS IN THE SAMPLE

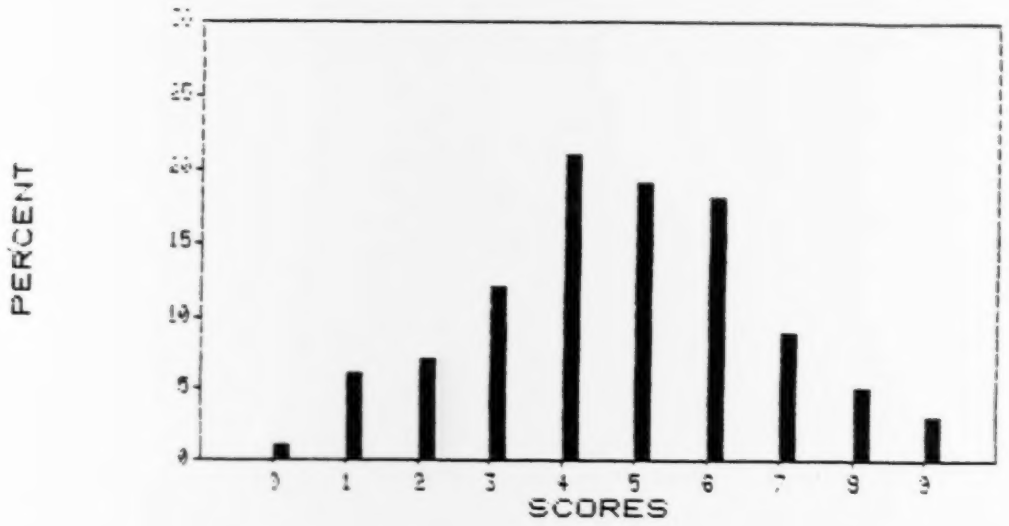

EXHIBIT 6b: DISTRIBUTION OF STUDENT SCORES BY PERCENTAGES: LOWER CLASSMEN

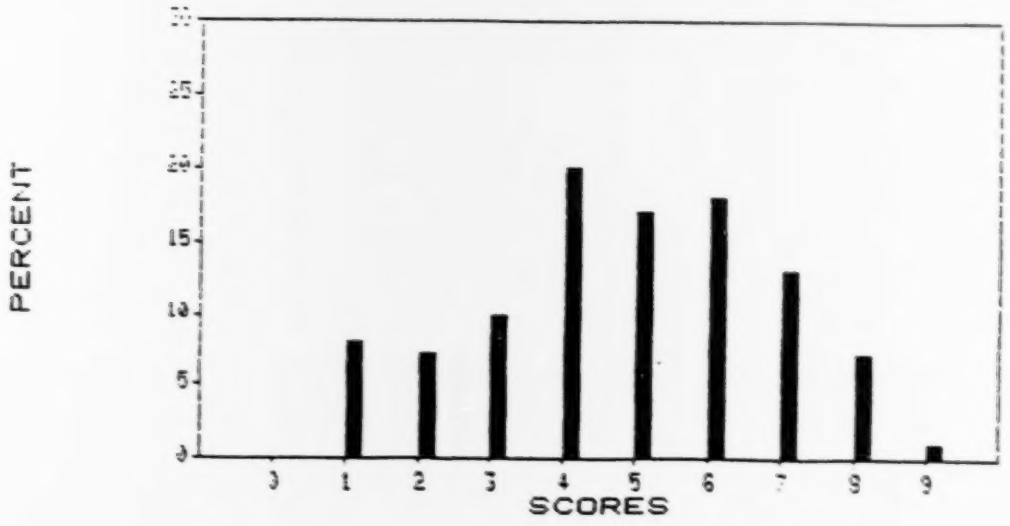

EXHIBIT 6c: DISTRIBUTION OF STUDENT SCORES BY PERCENTAGES: UPPER CLASSMEN

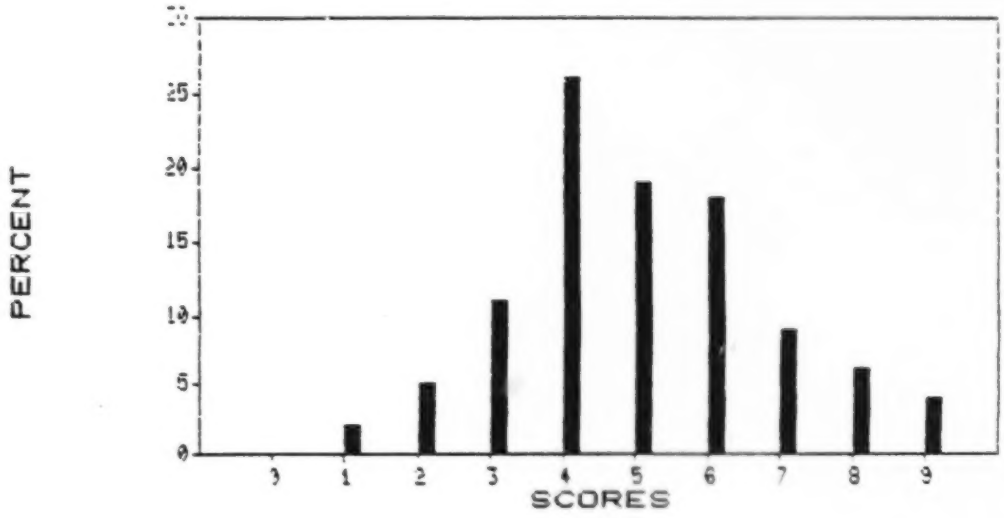

EXHIBIT 6d: DISTRIBUTION OF STUDENT SCORES BY PERCENTAGES: TRANSFER STUDENTS

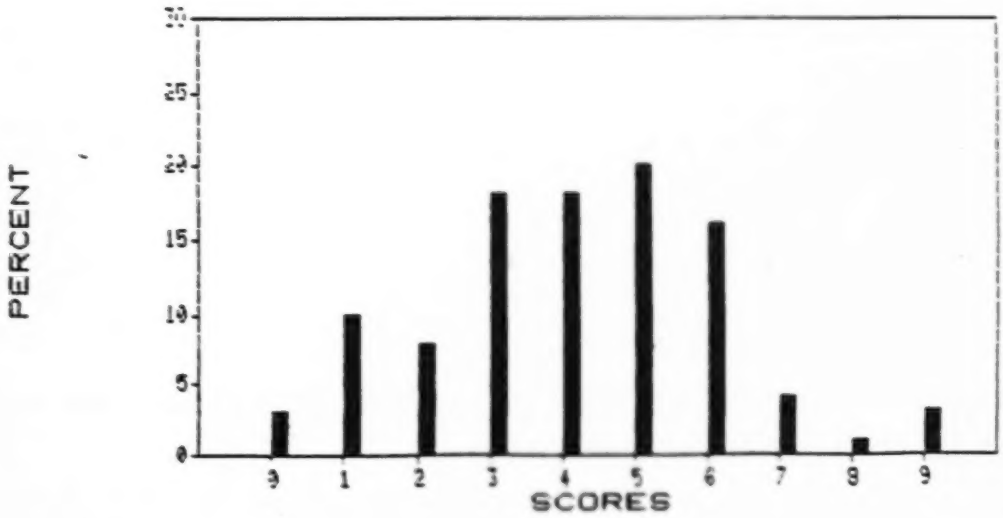

EXHIBIT 6e: DISTRIBUTION OF STUDENT SCORES BY PERCENTAGES: STUDENTS HAVING HAD ONE TO THREE COURSES

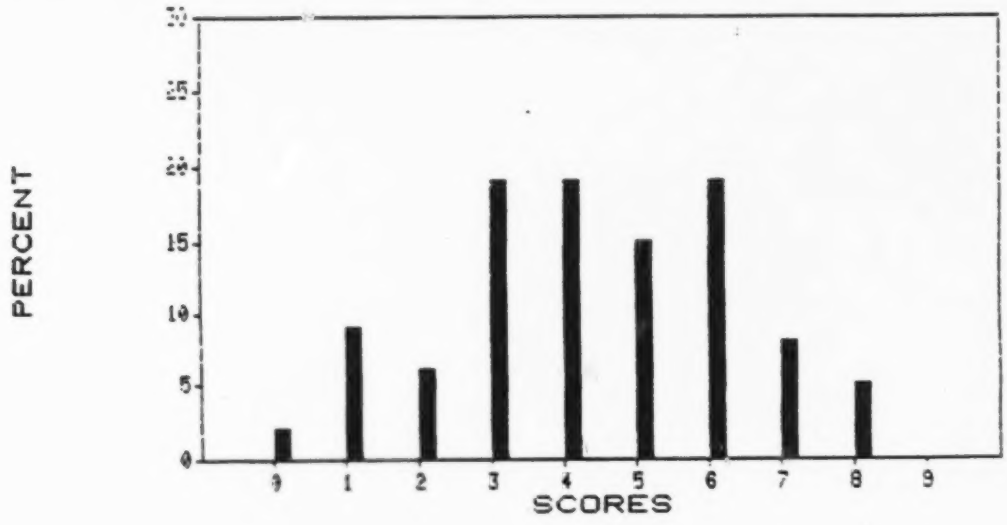

EXHIBIT 6f: DISTRIBUTION OF STUDENT SCORES BY PERCENTAGES: STUDENTS HAVING HAD FOUR TO SIX COURSES

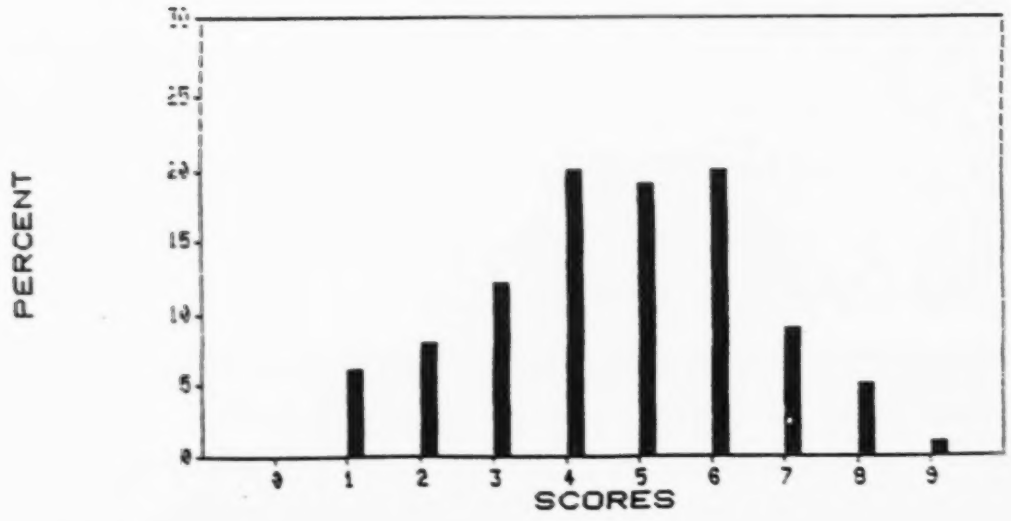

EXHIBIT 6g: DISTRIBUTION OF STUDENT SCORES BY PERCENTAGES: STUDENTS HAVING HAD SEVEN OR MORE COURSES

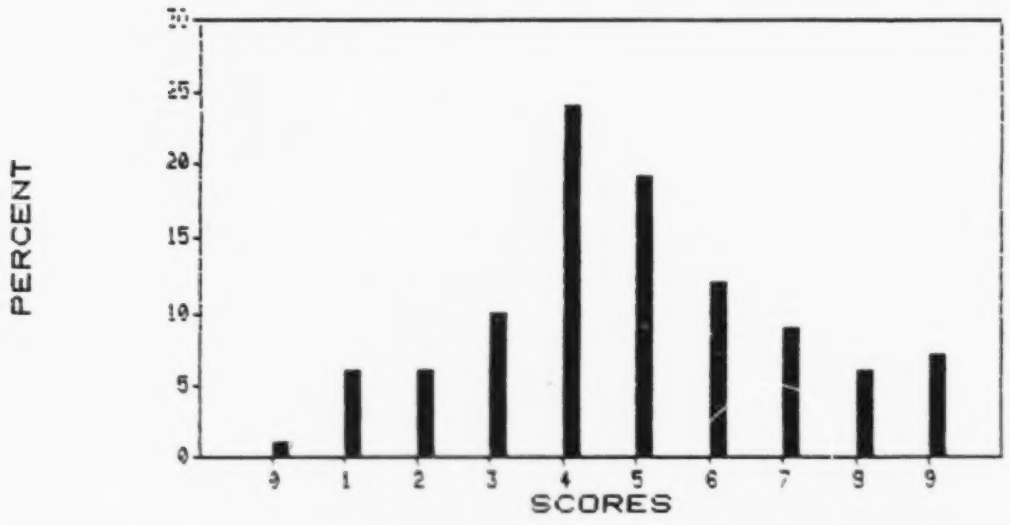

EXHIBIT 6h: DISTRIBUTION OF STUDENT SCORES BY PERCENTAGES: STUDENTS HAVING HAD UNKNOWN NUMBER OF COURSES

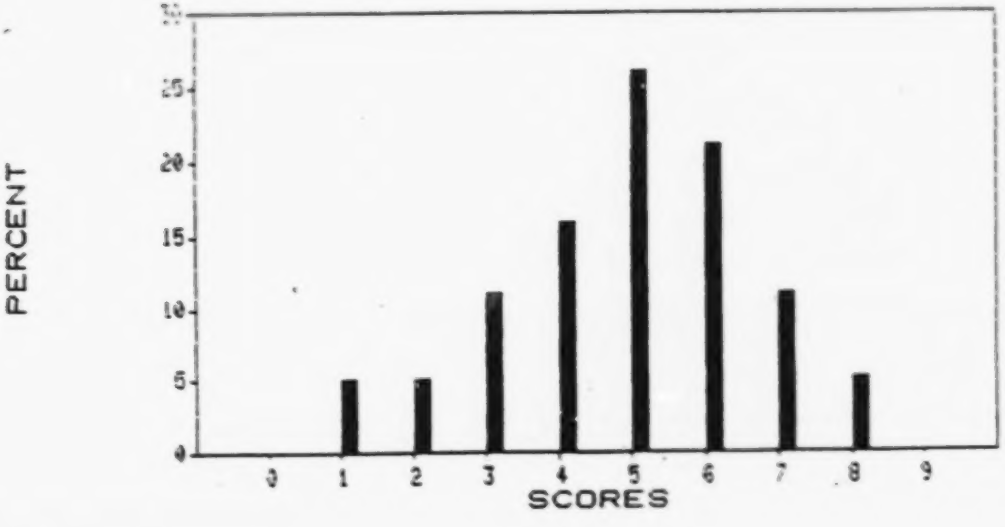

EXHIBIT 7a - TEST SCORES BY DIVISIONS AND NUMBER OF COURSES: LOWER CLASSMEN

		1-3	4-6	7+	?	ALL
DIV 1	N	11	7	1	1	20
	R	1.33-7.83	3.50-6.67	7.67	5.17	1.33-7.83
	M	5.67	5.17	7.67	5.17	5.25
	X	4.75	4.81	7.67	5.17	4.94
	SD	21.0	1.41			1.87
DIV 2	N	5	15	4	1	25
	R	5.17-8.50	1.67-8.00	1.67-9:00	1.17	1.17-8.00
	M	3.83	5.50	6.1	1.17	5.00
	X	4.67	5.06	5.75	1.17	4.94
	SD	1.10	1.83	2.75		2.03
DIV 3	N	5	7			12
	R	5.17-8.50	3.33-8.17			3.33-8.50
	M	7.25	6.00			7.17
	X	7.20	5.98			6.45
	SD	1.24	1.85			1.87
DIV 4	N	1	2			3
	R	1.67	5.33-6.00			1.67-6.00
	M	1.67	5.67			5.33
	X	1.67	5.67			4.33
	SD		0.24			1.91
DIV 5	N	8	13		1	22
	R	2.5-7.17	2.33-7.30		5.33	2.33-7.31
	M	4.33	5.33		5.33	4.81
	X	4.23	5.32		5.33	4.95
	SD	1.34	1.58			1.53
DIV 6	N	1	2	1		4
	R	4.17	3.17-4.33	4.67		3.17-4.67
	M	4.17	3.75	4.67		4.25
	X	4.17	3.75	4.67		4.05
	SD		0.58			0.77
DIV 7	N	4	1			5
	R	4.33-7.00	8.33			4.33-8.33
	M	4.84	8.33			6.67
	X	5.67	8.33			6.27
	SD	1.47				1.42
DIV ?	N					
	R					
	M					
	X					
	SD					
ALL	N	35	47	6	3	91
	R	1.33-8.50	1.67-8.33	1.67-9.00	1.47-5.33	1.17-9.00
	M	5.00	5.33	6.17	5.17	5.17
	X	4.98	5.27	5.89	3.89	5.21
	SD	1.92	1.74	2.42	1.92	1.74

EXHIBIT 7b: TEST SCORES BY DIVISIONS AND NUMBER OF COURSES: UPPER CLASSMEN, NON-TRANSFER

		1-3	4-6	7+	?	ALL
DIV 1	N	1	2	11	2	16
	R	2.33	3.33-5.00	3.83-8.67	3.00-4.50	2.33-8.67
	M	2.33	4.17	5.39	3.75	5.00
	X	2.33	4.17	5.67	3.75	5.03
	SD		0.81	1.38	0.75	1.59
DIV 2	N	2	3	12	2	19
	R	3.00-4.00	1.33-7.33	2.33-9.33	5.33-5.83	1.33-9.33
	M	3.50	4.17	5.33	5.58	5.00
	X	3.50	4.44	5.20	5.58	4.94
	SD	0.50	2.46	1.88	0.25	1.89
DIV 3	N		3	6		9
	R		3.33-6.00	4.00-9.67		3.33-9.67
	M		4.50	7.34		6.51
	X		4.61	7.31		6.41
	SD		1.09	1.82		2.06
DIV 4	N		1	11	1	13
	R		1.33	3.33-8.33	6.18	1.33-8.33
	M		1.33	4.67	6.18	4.67
	X		1.33	5.39	6.18	5.14
	SD			1.84		2.03
DIV 5	N	4	3	22	1	30
	R	4.83-8.33	4.67-6.17	2.33-9.00	6.63	2.33-9.00
	M	5.13	5.33	5.17	6.63	5.33
	X	5.60	5.39	5.28	6.63	5.37
	SD	2.23	0.61	0.81		5.17
DIV 6	N			38		1
	R			3.00		3.00
	M			3.00		3.00
	X			3.00		3.00
	SD					
DIV 7	N			3	1	4
	R			3.87-8.67	8.00	3.87-8.67
	M			8.33	8.00	8.17
	X			6.96	8.00	7.22
	SD			2.18		1.94
DIV ?	N			1	1	2
	R			6.87	6.17	6.17-6.87
	M			6.87	6.17	6.52
	X			6.87	6.17	6.52
	SD					0.35
ALL	N	7	12	67	8	94
	R	2.33-8.33	1.33-7.33	2.33-9.67	3.00-8.00	1.33-9.67
	M	4.83	4.50	5.33	6.00	5.33
	X	4.68	4.42	5.59	5.67	5.38
	SD	1.79	1.74	1.68	1.53	1.74

EXHIBIT 7c: TEST SCORES BY DIVISIONS AND NUMBER OF COURSES: UPPER CLASSMEN, TRANSFERS

		1-3	4-6	7+	?	ALL
DIV 1	N	5	5	3	1	14
	R	0.67-6.83	1.33-7.33	0.50-5.33	4.84	0.50-7.33
	M	4.67	5.50	5.17	4.84	5.17
	X	4.19	4.93	3.67	4.84	4.39
	SD	2.06	1.99	2.23		2.06
DIV 2	N	11	11	2	3	27
	R	1.17-6.84	1.33-6.00	3.17-4.67	3.67-6.87	1.17-6.87
	M	3.67	4.67	3.92	5.00	4.67
	X	4.05	4.48	3.92	5.17	4.31
	SD	1.86	1.29	0.75	1.28	1.57
DIV 3	N	3	4	3	1	11
	R	3.33-5.67	2.17-6.33	4.00-6.33	7.17	2.17-7.17
	M	4.33	4.83	4.33	7.17	4.85
	X	4.44	4.55	4.89	7.17	4.85
	SD	0.97	1.47	1.01		1.38
DIV 4	N	1	2	3		6
	R	6.50	2.33-6.17	1.33-5.00		1.33-6.50
	M	6.50	4.25	3.87		4.44
	X	6.50	4.25	3.40		4.20
	SD		1.92	1.54		1.90
DIV 5	N	1	3	3	2	9
	R	2.50	5.33-9.33	1.33-4.33	2.33-7.83	1.33-9.33
	M	2.50	6.00	1.67	5.08	4.33
	X	2.50	6.39	2.44	5.08	4.52
	SD		1.74	1.35	2.75	2.66
DIV 6	N	1	1	3	1	6
	R	6.33	3.00	2.00-9.00	5.33	2.00-9.00
	M	6.33	3.00	3.33	5.33	4.33
	X	6.33	3.00	4.78	5.33	4.83
	SD			3.03		2.37
DIV 7	N	1				1
	R	5.33				5.33
	M	5.33				5.33
	X	5.33				5.33
	SD					
DIV ?	N					
	R					
	M					
	X					
	SD					
ALL	N	23	26	17	8	74
	R	0.67-6.84	1.33-9.33	0.50-9.00	2.33-7.83	0.50-9.33
	M	4.33	5.00	4.17	5.17	4.67
	X	4.33	4.76	3.85	5.38	4.67
	SD	1.81	1.76	2.05	1.73	1.38

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